

PATENT SPECIFICATION

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(54) DEVICE FOR SCANNING IR PICTURES

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 TECHNIK, a German Kommanditgesell-
 schaft, of Schlosswolfsbrunnenweg 33-35,
 Heidelberg, Germany, do hereby declare the
 invention, for which we pray that a patent
 may be granted to us, and the method by
 which it is to be performed, to be particularly
 described in and by the following
 statement:—

The invention relates to a device for
 scanning infrared images, particularly
 thermal images, using a row of receiving
 elements, using the method according to
 co-pending application No.27812/68 (Serial
 No. 1,560,682). This method has the aim of
 keeping the picture sequence frequency as
 low as possible, with a view to a smaller
 bandwidth and the partly large time
 constants of the receiving elements.

It is known to scan IR pictures by means
 of a row of receiving elements disposed one
 below another, wherein the picture is
 guided by the scanning movement of an
 optical/mechanical system past the row of
 receiving elements, and a multi-line picture
 is produced according to the number of
 receiving elements. When a four-sided
 prism is used, a row of receivers may be
 scanned four times per revolution of the
 prism in this manner. However, this
 arrangement requires a receiving element
 for each line to be scanned, and if a usable
 picture is to be obtained, a large number of
 separate receiving elements is required.

It is an object of this invention to provide
 a scanning device in which fewer receiving
 elements can be used without substantial
 reduction of the picture size or quality.

According to this invention there is
 provided a device for scanning infrared
 images, having receiving elements arranged
 in a row, wherein each receiving element is
 used for scanning several lines successively
 and the partial images scanned by the
 individual receiving elements are combined
 to form a whole image, characterized by a
 rotating prism having its axis of rotation
 parallel to the row of receiving elements and

side faces inclined at different angles to the
 axis. 50

The invention makes it possible to scan,
 instead of one line as hitherto, several lines
 during one revolution, thus reducing the
 numbers of receiving elements under
 otherwise like conditions. 55

Preferably the side faces of the prism are
 so inclined to the axes of rotation that,
 during transition from one side face to the
 next, different lines are scanned, whereby
 over a full revolution all lines associated
 with a receiving element are scanned. 60

In using a scanning method in which two
 lines are each scanned twice per revolution,
 a four-sided prism is preferably used in
 which two opposite side faces are inclined
 to the axis of rotation at the same angle, but
 in opposite directions, the faces normal to
 the axis of rotation being square. 65

If two opposite faces are parallel and
 inclined to the axis of rotation, four lines are
 each scanned once per revolution with a
 four-sided prism. 70

If three or more than four faces are able
 to be scanned per revolution of the prism, a
 prism is used which has more than four, but
 an even number of side faces, for example, a
 six-sided prism. In this case, the faces are so
 formed that two opposite sides are inclined
 at the same angle, either parallel or in the
 opposite direction. 80

The invention will now be described in
 more detail by way of example, with
 reference to the accompanying drawings in
 which:— 85

Figure 1 is a diagram showing the general
 arrangement of a rotating scanning prism,
 viewed perpendicularly to the optical axis
 and to the axis of rotation;

Figure 2 (a-c) comprises three views of a
 scanning prism seen in the direction of the
 axis of rotation; 90

Figure 3 (a-b) comprises two views of a
 scanning prism with opposite surfaces
 inclined towards each other, seen
 perpendicularly to the optical axis and to
 the axis of rotation; 95

Figure 4 shows a grid (partly broken

away) scanned after one rotation of a prism according to Figure 3;

Figure 5 (a-d) comprise four views of a scanning prism with parallel opposite faces, seen perpendicularly to the optical axis and to the axis of rotation; and

Figure 6 shows a grid scanned after one rotation of the prism of Figure 5.

Figure 1 shows purely diagrammatically an input optical system 11.

Scanning is effected in a convergent beam by a prism 12 rotating about an axis 21. The end faces of the prism, perpendicular to the axis of rotation, are shown at 22 and 32. A row of receiving elements 13 is arranged behind the prism. Convergent beams 5, 6 are deflected at the prism input in the directions 15, 16 and in the directions 25, 26, when leaving the prism.

Figure 2 shows three different positions *a*, *b* and *c* of the prism for scanning perpendicularly to the row of receivers. This is a regular prism, i.e. a prism, the end faces of which are squares, with rectangular side faces perpendicular thereto. The points 1, 2 and 3 indicate individual image on scanning points which are successively reached during one revolution of the prism. All these points are located on one line which is thus scanned four times during one prism revolution.

In Figure 3, the side faces 7, 8, 17, 18 (contrary to the embodiment of Figure 2) are not parallel, but form a very acute angle with the axis of rotation 21, such that always two opposite sides 7, and 17, or 8 and 18 are inclined in opposite directions to the axis of rotation.

Since the angles formed by the sides 7, 17 with the axis of rotation 21 are equal, as are also the angles formed by the sides 8, 18 with the axis of rotation 21 the same beam path will result as shown in Figure 3a, if the side 7 is on the right and the side 17 on the left, i.e. after the prism has turned through 180°. The same also applies to the sides 8 and 18, in other words, during every revolution of the prism, the same position of the side face to the optical axis, and thus also the same beam path, are repeated every 180°. If the position of the prism shown in Figure 3a is designated I, the position 180° therefrom is designated III, the position of Figure 3b is designated II, and the position 180° therefrom is designated IV, line 1 is

scanned (Figure 4) with the prism in positions I and III and line 2 with the prism in positions II and IV, and one and the same receiving element is energised in all four positions. In the same way, lines 3, 4 and 5, 6 and so on to *n* and *n*+1, are each scanned by a further receiving element.

Figure 5 also shows a four-sided prism, in which, however, contrary to Figure 3, always two opposite sides, 7 and 17 or 8 and 18 are parallel. The sides 7, 17 are inclined to the axis of rotation at an angle 14, and the sides 8, 18 at a different angle 24. The angle 14 is such that, during the transition from the position I (Figure 5a) to the position III (Figure 5c), that is to say, during a revolution of the prism through 180 degrees, two lines are missed out or "jumped over," i.e. if the position I the *first* line is scanned, in position III the *fourth* line is scanned (see also Figure 6). On the other hand, the angle 24 is such that the line jumped between position II (Figure 5b) and position IV (Figure 5d) is only one line. Thus, if the *second* line is scanned in position II, the *third* line will be scanned in the position IV. If now the difference between the angles 14 and 24 is such that also the line jump from position I to position II is one line, there results automatically from position II to position III, and from position III to position IV always a jump of only one line. Thus, the lines 1 to 4 in Figure 6 are scanned in the position indicated by the Roman numerals, i.e. in the sequence 1, 2, 4, 3.

WHAT WE CLAIM IS:—

1. Device for scanning infrared images, having receiving elements arranged in a row, wherein each receiving element is used for scanning several lines successively and the partial images scanned by the individual receiving elements are combined to form a whole image, characterised by a rotating prism having its axis of rotation parallel to the row of receiving elements and side faces inclined at different angles to the axis.

2. Device according to claim 1, wherein the side faces are inclined to the axis so that during transition from one side face to the next side face, different lines are scanned, and so that during a full revolution of the prism all lines associated with one receiving element are scanned.

3. Device according to claim 1 and claim 2, wherein two opposite side faces are inclined to the axis at the same angle but in opposite directions. substantially as herein described, with reference to the accompanying drawings. 10
- 5 4. Device according to claim 1 or claim 2 wherein two opposite side faces are parallel and inclined to the axis of rotation.
5. Device for scanning infrared images

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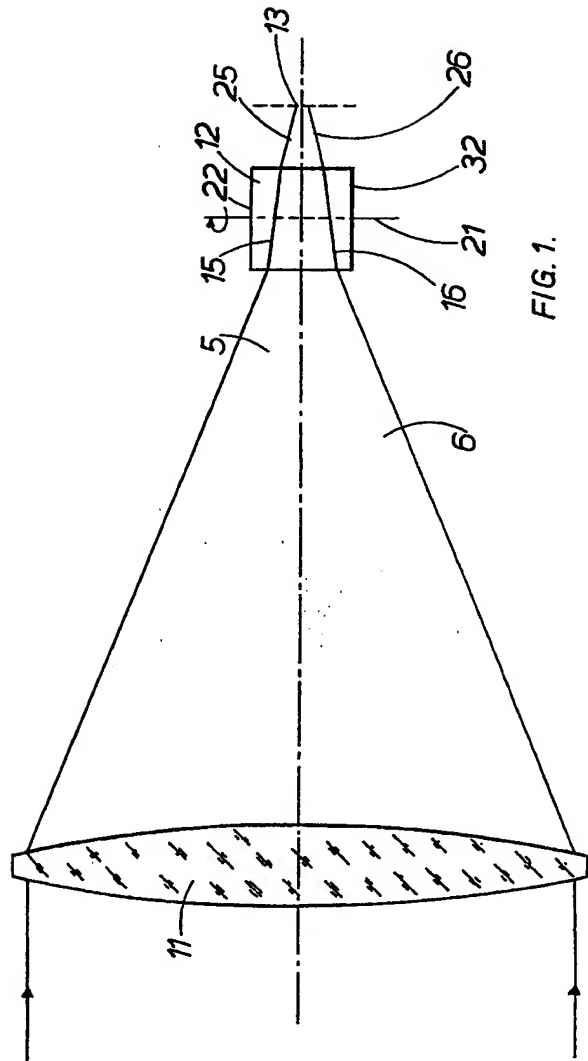
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COMPLETE SPECIFICATION

3 SHEETS

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Sheet 1



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COMPLETE SPECIFICATION

3 SHEETS

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Sheet 2

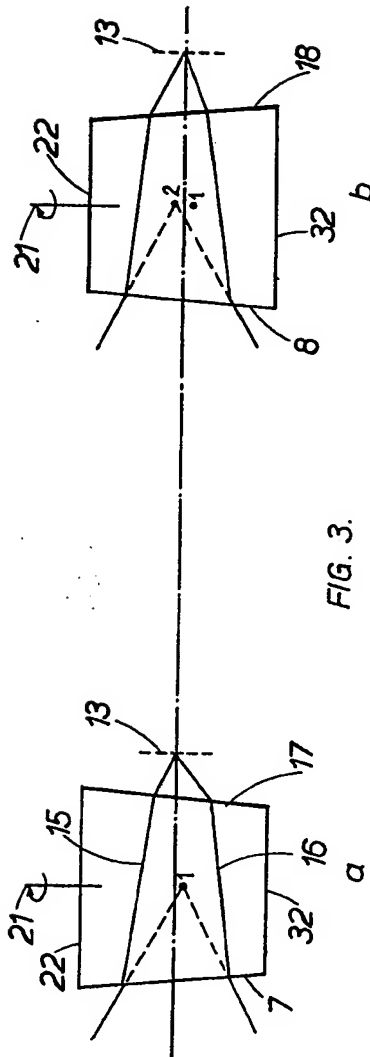
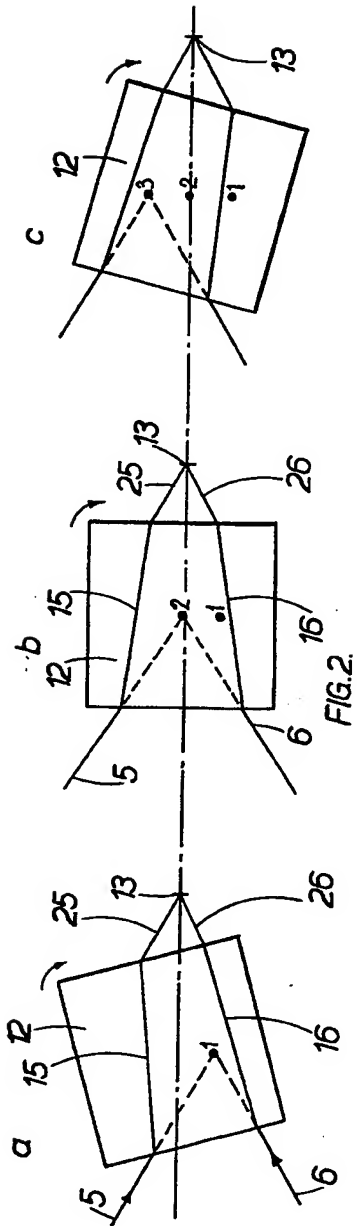


FIG. 3.

